

Case Study: Car-Mounted Lens Heating Solution Using Aerosol Jet Printing

Company: AJP Electronics

Industry: Automotive Electronics

Location: China

Technology Partner: Aerosol Jet Technology (HD2 Platform)

Background

With the rapid adoption of advanced driver assistance systems (ADAS) and autonomous driving technologies, modern vehicles are increasingly dependent on camera systems. These include front, rear, and side-mounted cameras integrated into critical areas such as the B-pillar. However, a recurring challenge affecting the performance of these systems is **lens fogging**, which limits driver visibility and hinders the effectiveness of automated functions like reversing, parking, and obstacle detection.



Side-mounted camera

B pillar is blurred, automatic assisted driving and automatic parking are limited



Built-in camera

Traffic voucher judgment is limited, and the monitoring of drivers and passengers is limited



Rear camera

Obry vision is not conducive to reversing safety, automatic parking limited



Front camera

The front vision is blurred, and the automatic driving, monitoring and ranging system are limited

Objective

AJP Electronics sought to develop a **functional heating solution** for camera lenses to eliminate fog accumulation and improve safety and system reliability. The goal was to use **digital manufacturing** to:

- Print a **silver serpentine heater pattern** on the circumference of Aluminium lens holders.
- Meet specific electrical and mechanical targets:

- Line width: 500 μm
- Serpentine length: 37 mm
- Serpentine width: 8 mm
- Resistance range: 5–10 Ohms
- Pass adhesion tape testing



Solution: Aerosol Jet Printing

AJP adopted **Aerosol Jet Printing (AJP)**, a contactless, high-resolution additive manufacturing technology suitable for complex 2D and 3D surfaces. The project utilized:

- **Silver nanoparticle ink** with a fluoropolymer additive for improved environmental resistance.
- A **medium-size nozzle** to print fine patterns without mechanical contact.
- A **custom fixturing system** involving a rotary motor and XY stage to rotate and print along the cylindrical Aluminium surface.



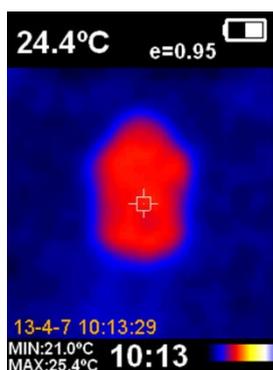
Process & Results

Printing Process Highlights:

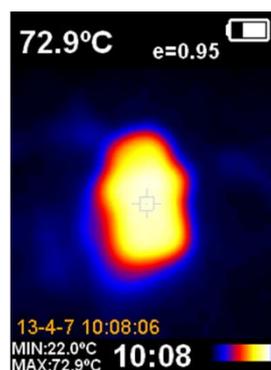
- Precise motion in phi (rotation) and Y-axis for accurate deposition.
- Sintering of the printed ink at optimized conditions to achieve target conductivity.
- Tape tests confirmed strong adhesion with no residue.

Performance Testing:

- Initial heater resistance measured at **24 Ohms**.
- When powered at **10V**, the heater reached **73°C**.
- Thermal imaging validated uniform heating across the pattern.
- Transient heating curves showed 50% of final temperature achieved in **~70 seconds**, consistent with theoretical expectations from Ohm's Law.



- No Power
- Ambient conditions



- Powered at 10 Volts
- Heated to 73 C

Production Deployment

AJP scaled the solution to **mass production**, delivering:

- **2 million heater units/month**
- Using the **Aerosol Jet HD2** platform integrated with automation services

HD2 Highlights:

- High-speed digital printing with trace widths down to 10 microns
- 300×300 mm vacuum platen with full XYZ motion coordination
- Optional 4th-axis rotation support for custom fixturing
- Configurable to handle multiple parts simultaneously with 60° incremental rotations

Custom fixturing solutions were recommended for rotational alignment, enabling efficient printing without requiring full synchronization with XYZ motion.



Conclusion

AJP Electronics' implementation of Aerosol Jet Printing for automotive camera lens heaters demonstrates the **power of additive manufacturing** in solving critical functional challenges. The digitally printed heater pattern offers:

- **Enhanced safety and visibility**
- **Scalability to high-volume production**
- **Reduced material and tooling costs**
- **Design flexibility for future innovations**

This case sets a precedent for using conformal additive electronics in the automotive sector, showcasing a successful path from prototype to mass production.